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WITNESS my hand this
Nineteenth day of August 2003

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AUSTRALIA
Patents Act 1990

PROVISIONAL SPECIFICATION

Invention Title: MATERIAL HANDLING SYSTEM & METHOD

Applicant: P & G DEVELOPMENTS PTY LTD

The invention is described in the following statement:

MATERIAL HANDLING SYSTEM & METHOD

The present invention relates generally to a material handling system and method, and more particularly to a material handling system and method for a product to be manually processed by an operator at a work-station.

The present invention has particular application to the food processing industry and, specifically, to the handling and processing of meat and poultry prior to packaging for supermarket shelves. It will therefore be convenient to hereafter describe the invention in this context. It should be appreciated, however, that the invention is not limited to use within the food processing industry, but that it may also be suitable for use in the handling and processing of a variety of other products.

Cuts of meat and poultry, such as pork, lamb, beef and chicken, are typically sold as pre-packaged items in supermarkets. These pre-packaged cuts are usually supplied to the supermarkets by meat and poultry processing and packaging specialists. To date, the preparation of those packages has been very labour intensive, not only in the necessary manual operations of trimming and cutting larger meat portions to achieve the desired steaks, fillets and other cuts, but also in handling of the product and packaging both before and after the trimming and cutting operations. The present invention is therefore directed to providing an integrated material handling system and method to improve the efficiency and economy of the overall packaging and production process.

According to one aspect of a first inventive concept, the invention provides a material handling system for a product to be manually processed by an operator at a work-station, including:

batch delivery means for automatically delivering batches of the product to the work-station on an "as required" or "on demand" basis for manual processing by the operator; and

packing container delivery means for automatically delivering individual packing containers to the work-station on an "as required" or "on demand" basis for filling with the product after manual processing by the operator.

In a very preferred form of the invention, the work-station is any one of a plurality of separate work-stations belonging to the material handling system.

In a preferred form of the invention, the batch delivery means includes means for sensing or identifying when a batch of product is required at any work-station. Each batch of product is preferably provided in a batch container, and the batch delivery means further preferably includes a shuttle device for transporting a batch container from a product supply station to that one of the work-stations identified as requiring the product batch. The batch delivery means also preferably includes a mechanism for transferring the batch container from the shuttle device to an access position for the operator at the work-station.

In a preferred form of the invention, the packing container delivery means includes means for sensing or identifying when a packing container is required at any work-station, and means for conveying individual packing containers to that one of the work-stations identified as requiring the packing container. The packing container delivery means furthermore preferably includes means for guiding delivery of the packing containers to a filling position at each of the operator work-stations. In the filling position, the packing container is located where the operator can fill it with the product (eg cuts of meat or poultry) after that product has been manually processed (eg trimmed and cut).

In a preferred form of the invention, the material handling system further includes packing container dispatch means for automatically dispatching product-filled packing containers from the work-station on an "as required" or "on demand" basis. The packing container dispatch means preferably includes a mechanism to remove the product-filled packing container from the filling position at the work-station, and an actuator device for use by the operator to

actuate the removal mechanism when that filled packing container is ready for dispatch. A packing container is typically ready for dispatch when the operator considers that enough product has been placed in it. The removal mechanism of the packing container dispatch means is furthermore preferably adapted to discharge the product-filled packing container to a conveyor for carrying that container to a final packaging station.

In a preferred form of the invention, the material handling system further includes batch container dispatch means for automatically dispatching the batch containers from each work-station on an "as required" or "on demand" basis. The batch container dispatch means preferably includes a mechanism to remove the batch container from the access position at the work-station, and an actuator device for use by the operator to actuate the removal mechanism when that batch container is ready for dispatch. A batch container is typically considered ready for dispatch from the access position when the operator has emptied it and manually processed all of its product. The mechanism to remove the emptied batch container from the access position is preferably adapted to transfer that container to a conveyor, which is able to carry it to a batch container return station.

In a preferred form of the invention, the material handling system is in the form of a processing line, and has most of the conveying and transporting operations occurring along a substantially common, primary line of direction. The operator work-stations are preferably spaced apart along that primary line with the work-stations located either just on one side or, alternatively, on both sides of that line.

The "as required" or "on demand" feature of the present invention assists in the optimisation of operation of the system. This feature facilitates almost continuous manual processing (eg trimming and cutting) by the operators at the work-stations, and eliminates timing consuming manual handling of batch containers and/or packing containers. The system of the invention also has the major advantage of facilitating precise tracking of meat and poultry product

throughout the processing operation. Each individual packing container is traceable to the specific batch container that was in the particular operator access position at the time that packing container was filled, and the batch container lots are themselves traceable to the bulk meat/poultry lots and/or animal carcasses handled by the company.

In a preferred form of the invention, this "as required" or "on demand" feature of the present invention operates in the following way. When an operator actuates the mechanism to remove an empty batch container from the batch access position at the work-station, the batch delivery means senses or identifies that a new batch is required and proceeds to deliver another batch container of product to that work-station when the access position is vacant. The new batch is preferably transported from a product supply station via a shuttle device. Similarly, when an operator actuates the mechanism to remove a product-filled packing container from the filling position at the work-station, the packing container delivery means senses or identifies that a new packing container is required and proceeds to deliver another one to the work-station when the filling position is vacant.

To minimise time delays between removal of one batch container or packing container and arrival of the next, the material handling system of the invention preferably provides a batch container buffer and/or a packing container buffer adjacent the work-station. That is, the batch delivery means preferably includes a batch container buffer that holds the next batch container of product in a buffer position adjacent the work-station. This results in the next batch container being ready for deployment or delivery to the operator access position as soon as dispatch of the current batch container is actuated. Furthermore, the packing container delivery means also preferably includes a packing container buffer that holds the next one or more (eg three or four) packing container(s) in another buffer position adjacent the work-station. The next packing container is thereby also ready for delivery to the filling position as soon as dispatch of the current product-filled packing container is actuated. As the batch container buffer or the packing container buffer becomes depleted,

the respective batch or packing container delivery means described above re-supplies it.

According to another aspect of the first inventive concept, the invention provides a material handling method for a product to be processed manually by an operator at a work-station, including the steps of:

automatically delivering discrete batches of the product to the work-station on an "as required" or "on demand" basis for manual processing by the operator; and

automatically delivering individual packing containers to the work-station on an "as required" or "on demand" basis for filling with the product processed by the operator.

In a preferred form of the invention, the material handling method further includes the step of: automatically dispatching each product-filled packing container from the work-station on an "as required" or "on demand" basis.

In a preferred form of the invention, each batch of product is supplied in a batch container and the method further includes the step of: automatically dispatching the batch container from the work-station on an "as required" or "on demand" basis.

According to one aspect of a second inventive concept, the invention provides a material handling system for a product to be manually processed by an operator at a work-station, including:

batch delivery means for automatically delivering batch containers of the product to the work-station on an "as required" or "on demand" basis for manual processing by the operator; and

batch container dispatch means for automatically dispatching the batch containers from the work-station on an "as required" or "on demand" basis.

In a preferred form of the second inventive concept, the material handling system includes packing container delivery means for automatically delivering

individual packing containers to the work-station on an "as required" or "on demand" basis for filling with the product after manual processing by the operator. Furthermore, in a preferred form of the second inventive concept, the material handling system further includes packing container dispatch means for automatically dispatching product-filled packing containers from the work-station on an "as required" or "on demand" basis.

In a very preferred form of the second inventive concept, the work-station is any one of a plurality of separate work-stations belonging to the material handling system.

According to another aspect of the second inventive concept, the invention provides a material handling method for a product to be manually processed by an operator at a work-station, including the steps of:

automatically delivering discrete batch containers of the product to the work-station on an "as required" or "on demand" basis for manual processing by the operator; and

automatically dispatching the batch containers from the work-station on an "as required" or "on demand" basis.

In a preferred form of the second inventive concept, the material handling method further includes the step of: automatically delivering individual packing containers to the work-station for filling with the product after manual processing by the operator on an "as required" or "on demand" basis.

In a preferred form of the second inventive concept, the material handling method further includes the step of: automatically dispatching each product-filled packing container from the work-station on an "as required" or "on demand" basis.

According to one aspect of a third inventive concept, the invention provides a material handling system for a product to be manually processed by an operator at a work-station, including:

packing container delivery means for automatically delivering individual packing containers to the work-station on an "as required" or "on demand" basis for filling with the product after manual processing by the operator;

packing container dispatch means for automatically dispatching product-filled packing containers from the work-station on an "as required" or "on demand" basis.

In a preferred form of the third inventive concept, the material handling system includes batch delivery means for automatically delivering batch containers of the product to the work-station on an "as required" or "on demand" basis for manual processing by the operator. Furthermore, in a preferred form of the third inventive concept, the material handling system includes batch container dispatch means for automatically dispatching the batch containers from the work-station on an "as required" or "on demand" basis.

In a very preferred form of the third inventive concept, the work-station is any one of a plurality of separate work-stations belonging to the material handling system.

According to another aspect of the third inventive concept, the invention provides a material handling method for a product to be processed manually by an operator at a work-station, including the steps of:

automatically delivering individual packing containers to the work-station for filling with the product after manual processing by the operator on an "as required" or "on demand" basis; and

automatically dispatching each product-filled packing container from the work-station on an "as required" or "on demand" basis.

In a preferred form of the third inventive concept, the material handling method further includes the step of: automatically delivering discrete batch containers of the product to the work-station for manual processing by the operator on an "as required" or "on demand" basis.

In a preferred form of the third inventive concept, the material handling method further includes the step of: automatically dispatching the batch containers from the work-station on an "as required" or "on demand" basis.

For assistance in arriving at an understanding of the inventive concepts above, an example of the material handling system and method of the invention is hereafter described with reference to the accompanying drawings. The preceding description of the system and apparatus may also be read with reference to those drawings. However, as the drawings illustrate one example only, their particularity is not to be understood as superseding the generality of the preceding description.

In the drawings:

Fig. 1 is a plan view of a material handling system according to the invention in the form of a processing and/or production line;

Fig. 2 is a side elevation of the material handling system in Fig. 1 showing details of the system at a work-station; and

Fig. 3 is a detailed end view of that part of the packing container dispatch means identified as "A" in Fig. 2.

With reference to Fig. 1 and Fig. 2, the particular example of the material handling system illustrated is a processing line 100, along which portions of meat and poultry are manually trimmed and cut by operators 0 at a plurality of work-stations 10. The operators then place the resultant cuts of meat in packing containers, typically trays, destined for the shelves of supermarkets.

The processing line 100 includes a central frame 1, which supports the primary conveying or transport mechanisms of the system. The frame 1 extends generally longitudinally of the processing line and the operator work-stations 10 are positioned next to one another along the length of the frame 1 and at each

of its opposite sides. In this example, the material handling system of the invention has twelve work-stations 10, with six arranged along either side of the central frame 1. Because each of the work-stations in this example is configured and operates essentially identically, it will be convenient to now focus the description of the system on a single work-station, with reference to Figs. 2 and 3.

The material handling system 100 includes a batch delivery means 20 for delivering batches of meat portions to be trimmed and cut to each of the work-stations 10. Each of the batches is provided in a container 21 called a tote crate and the batch delivery means 20 includes a shuttle device 22 for transporting a full tote crate 21 to a work-station 10 identified as requiring a new batch of product for processing. The shuttle device 22 is mounted on the frame 1 and includes a carriage 23, which supports the full tote crate 21 for transport along a linear drive unit 24. The carriage 23 is adapted for travel on the linear drive unit 24 from a supply station 25 to any one of the work-stations 10. The batch delivery means 20 further includes a mechanism 26 for transferring the full tote crate from the carriage 23 to an operator access position 11 at the designated work-station. The transfer mechanism 26 includes a pneumatic cylinder 27 and is adapted to tilt the carriage 23 to either side of the linear drive unit 24 (as required) so that the tote crate slides off the carriage towards the work-station 10.

The batch delivery means 20 also includes a tote crate buffer 30 adjacent the work-station for holding a full tote crate 21 in reserve, ready for immediate delivery to the operator access position 11 when required. The mechanism 26 actually transfers the full tote crate from the carriage 23 to the buffer 30 as an interim position before reaching the access position 11 at the work-station 10. The tote crate buffer 30 includes a sloped support plate 31 and a removable stop 32 for selectively retaining a tote crate in the buffer. If the access position already has a tote crate, the stop 32 will hold the buffer crate in check. When the tote crate in the access position 11 is removed, the stop 32 is deactivated, eg moved pivotally out of the way, thereby releasing the crate on

the buffer support plate 31 to slide into the access position 11 at the work-station.

Importantly, the batch delivery means 20 furthermore includes means for sensing or identifying when a new tote crate is required at any one of the work-stations 10, ie when the access position 11 has been vacated. This enables the tote crates to be delivered to the work-stations on an "as required" or "on demand" basis. The tote crate 21 in the buffer 30 is available to immediately re-supply the operator at the work-station when the tote crate currently being accessed by the operator is emptied and then removed. The stop 32 is deactivated enabling the tote crate 21 in the buffer 30 to slide off the support plate 31 and into the operator access position 11. At the same time, the batch delivery means 20 is cued to deliver a new full tote crate to the work-station to re-supply the buffer 30, which was depleted to fill the vacant access position 11.

At the access position 11, a tote crate sits on a support plate 12 within easy reach of the work-station operator, positioned at an angle to facilitate access to its contents. The operator typically takes meat portions from the tote crate one at a time, places them on the chopping board 13, cuts off the fat and discards it through an aperture 14 at the side of the board, and slices the portion into fillets, steaks etc. for packing. Any small off-cuts of meat (called trim) are also discarded, but through a separate aperture 15 at the top of the board. Each work-station 10 is mounted or supported on a separate frame 2 laterally spaced from the central frame 1, and the work-station frame 2 supports an off-cuts conveyor 3 which passes beneath each work-station to collect the fat and trim off-cuts discarded through the apertures 14,15. The off-cuts conveyor 3 is longitudinally divided by a partition 4 into a region for fat and a region for trim, and each is carried to a specific collection bin, as shown in Fig. 1. A small partition wall 18 is also provided at each of the work-stations 10 to ensure that no off-cut fat is accidentally 'flicked' from one work-station to another as it is directed to the aperture 14.

Once an operator at a work-station 10 has finished processing all of the meat or poultry portions in the tote crate 21 currently at the access position 11, the operator needs to remove the now empty tote crate and make room for delivery of the next full one. The material handling system 100 therefore also includes a tote crate dispatch means 40 for automatically dispatching the tote crates 21 from the access position 11 on demand or as required. The tote crate dispatch means 40 includes an actuator device 41 for use by the operator to actuate a removal mechanism 42 when the operator has finished processing the entire contents of the current tote crate.

The removal mechanism 42 includes a pneumatic cylinder 43 and is adapted to pivot the support plate 12, which is hinged to the work-station 10, to a discharge position 44 shown in dashed lines in Fig. 2. In the discharge position 44, the tote crate 21 slides off the support plate 12 and onto the elevated transfer plate 45. The support plate 12 may then return to its original orientation defining the access position 11, ready to receive the next full tote crate from the buffer 30. The transfer plate 45 meanwhile is lowered by a pneumatic mechanism 46 to the horizontal position shown, and a pneumatic ram 47 is provided to push the empty tote crate onto a conveyor 48 adapted to carry the crate to a crate return station (not shown). The conveyor 48 is preferably divided or partitioned into a plurality of discrete crate-carrying segments, and the pneumatic ram device 47 is desirably controlled to delay advancing the crate onto the conveyor 48 until such time as the segment of the conveyor passing the crate is free or available, ie not already occupied.

The system 100 of the invention also includes a packing tray delivery means 60 for automatically delivering individual packing trays 61 to each work-station 10 identified as requiring another tray. The packing tray delivery means 60 includes conveyor means in the form of two separate belt conveyors 62 mounted on top of the frame 1. Each of the belt conveyors 62 transports packing trays 61 from a tray supply station 63 along the processing line to the work-stations 10, and each belt conveyor services the work-stations 10 on one side of the line 100. At each of the work-stations, the packing tray delivery

means 60 further includes a feed ram 64 (again preferably pneumatically driven) and a chute or ramp 65 for guiding delivery of the packing trays 61 from the respective belt conveyor 62 to a filling position 16 at each work-station.

When the filling position 16 at a work-station is unoccupied, a packing tray slides down the guide chute 65 and, assisted by carefully directed air jets, glides into a movable tray caddy 66 aligned with the chute at the work-station 10. The caddy 66 then lifts the new tray 61 into the filling position 16. At the filling position 16, the packing tray is positioned with its open top facing up and accessible through an aperture in a cover plate 17 adjacent to the chopping board 13 at the work-station. An outwardly projecting flange-type rim 67 of the tray is pressed against the underside of the cover plate 17 when the caddy 66 raises the tray into position. This not only firmly secures the tray in the filling position, but also keeps the rim hidden or covered, thereby keeping it clean for sealing with a film layer in a later, final packaging step. At the filling position 16, the tray 61 is within easy reach of the work-station operator and, after trimming and cutting the meat portions taken from the tote crate in the access position, the operator places the fillets, steaks or other cuts of meat and poultry within the empty tray.

The packing tray delivery means 60 also includes a packing tray buffer 70 for holding a number of packing trays in reserve, ready for immediate delivery to the filling position 16 when required. The feed ram 64 actually feeds the packing trays 61 into the buffer 70, which is located on the guide chute 65. The buffer 70 in this particular case holds four packing trays 61, with the first buffer tray isolated from the filling position by a first tray stop 71, and from the other trays in the buffer 70 by a second tray stop 72. In this example the tray stops 71,72 are retractable rod-like elements which project upwardly from below the chute or ramp 65 to engage a front of the trays and thereby prevent their further progress towards the filling position. Each of the tray stops 71,72 may be deactivated or retracted to prevent their interference with the trays.

The packing tray delivery means 60 furthermore includes means for sensing or identifying when a packing tray is required at one of the work-stations, ie when the filling position 16 has been vacated. This enables the packing trays to be delivered to the work-stations as required or on demand. The packing trays in the buffer 70 are available to immediately re-supply the operator at the work-station when the tray currently being filled by the operator is removed from the filling position. When the filling position is identified as empty, and therefore as requiring a new packing tray, the first tray stop 71 is deactivated (ie retracted) enabling the first packing tray in the buffer 70 to slide down the guide chute 65 and into the caddy 66 to be raised into the operator filling position 16. The first tray stop 71 is then reactivated and the second tray stop 72 deactivated, enabling the packing tray previously in the second buffer position to move forward into the first buffer position. The second tray stop 72 is then also reactivated to again isolate what is now the first buffer packing tray from the other trays 61 in the buffer 70. At the same time, the packing tray delivery means 60 is cued to deliver a new empty packing tray 61 from the belt conveyor 62 to re-supply the buffer 70, which was depleted to supply the vacant filling position 16.

As an operator at a work-station cuts and trims the meat and poultry portions from the tote crate 21 in the access position, the resultant choice cuts are placed in the packing tray 61 at the filling position 16. Naturally, each packing tray will only contain one or two, or perhaps three, separate cuts, so each packing tray will be filled and require replacement relatively quickly. For example, for each single tote crate of product processed by the operator, many separate packing trays will be required. The system of the invention therefore also includes a packing tray dispatch means 80 for automatically dispatching product-filled packing trays from the work-station on demand or as required. The packing tray dispatch means 80 includes an actuator device 81 for use by the operator to actuate a removal mechanism 82 adapted to automatically remove a product-filled packing tray 61 from the filling position 16 when the operator considers that enough product has been placed in it.

The removal mechanism 82 is illustrated in Figs. 2 and 3 and is adapted to lower the packing tray caddy 66 and deposit the filled tray on a transit surface 83 directly below the filling position 16. The removal mechanism 82 further includes a pusher 84, which is designed to engage the tray at this location and drive it out of the caddy 66 and along the transit surface 83 towards a conveyor 85 mounted on the central frame 1. The packing tray caddy 66 is then free to return to its initial position in alignment with the guide chute or ramp 65 to receive a new packing tray 61 from the tray buffer 70. The conveyor 85 is arranged to carry the filled tray to a final packaging station (not shown) where a film covering will be applied to the upper rim of the tray and the product will be weighed and priced. Like conveyor 48, the conveyor 85 is preferably divided or partitioned into a plurality of discrete tray-carrying segments, and the pusher 84 is desirably controlled to pause or delay actually advancing the tray onto the conveyor until the segment of the conveyor passing the tray is free or available, ie not already occupied. Furthermore, the conveyor 85 is divided longitudinally by partition 86 so that use of a single conveyor can be maximised by the work-stations at either side of the central frame 1.

In operation, the processing line 100 enables the operators at the work-stations to devote their time almost exclusively to the task of manually processing the meat and poultry delivered to the work-stations. Tote crates full of product to be processed are delivered automatically when a work-station is identified a requiring one, and the operator actuates the tote crate's automatic dispatch (by pressing a knee-activated button, for example) when all of the product it contained has been processed. This actuation itself may serve as the control system trigger for sensing or detecting when a new batch crate of product should be delivered to that work-station. Similarly, packing trays to be filled by the operators are also automatically delivered one at a time to the work-station when the work-station is identified a requiring one. And the operator actuates each packing tray's automatic dispatch (again, for example, by pressing a knee-activated button) when the operator considers it has been sufficiently filled. This actuation may also serve as the control system trigger for

sensing or detecting when a new packing tray should be delivered to that work-station.

Since the delivery and dispatch of product both before and after processing is automatically controlled, the system of the invention lends itself to monitoring or tracking the passage of product throughout the system. Each packing tray filled and dispatched can be traced to a particular work-station and the particular tote crate from which the meat or poultry came. And the tote crates can themselves be traced to a particular bulk meat or poultry lot and/or animal carcass handled by the processing and packaging company.

The processing line 100 described is preferably fabricated substantially entirely from stainless steel since it will need to be washed-down once every day to ensure sanitary standards are maintained. The electric and electronic power and control systems built into the material handling system of the invention will desirably be fully housed within water-tight enclosures for their protection. For example, elevated casings 90 shown in Fig. 2 may house the electric and electronic power and control systems.

Finally, it is to be understood that various modifications and/or additions may be made to the system and method described above without departing from the spirit or ambit of the present invention.

DATED: 27 February 2001
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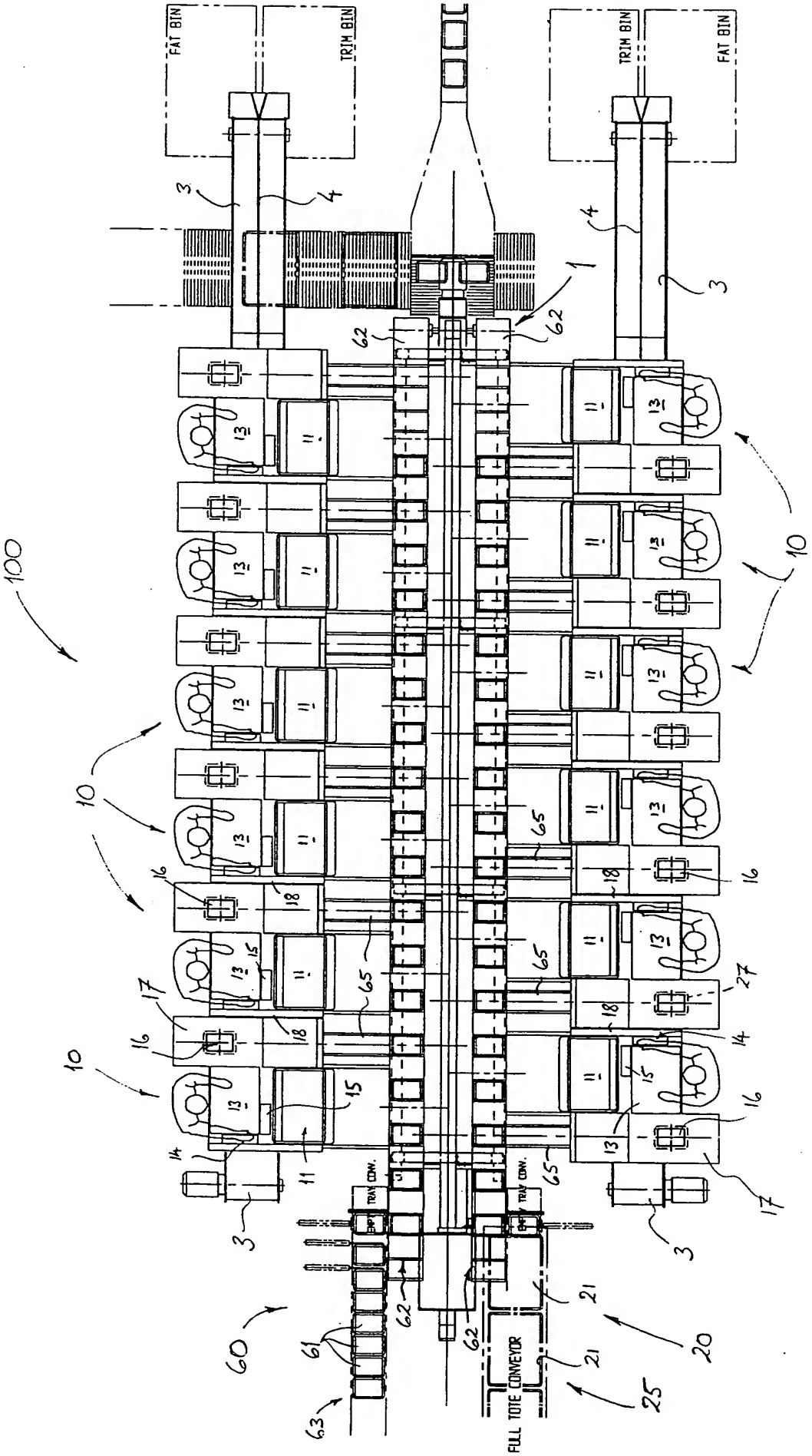
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FULL TOTE CONVEYOR
TRAY CONV.
TRAY CONV.

Fig. 1

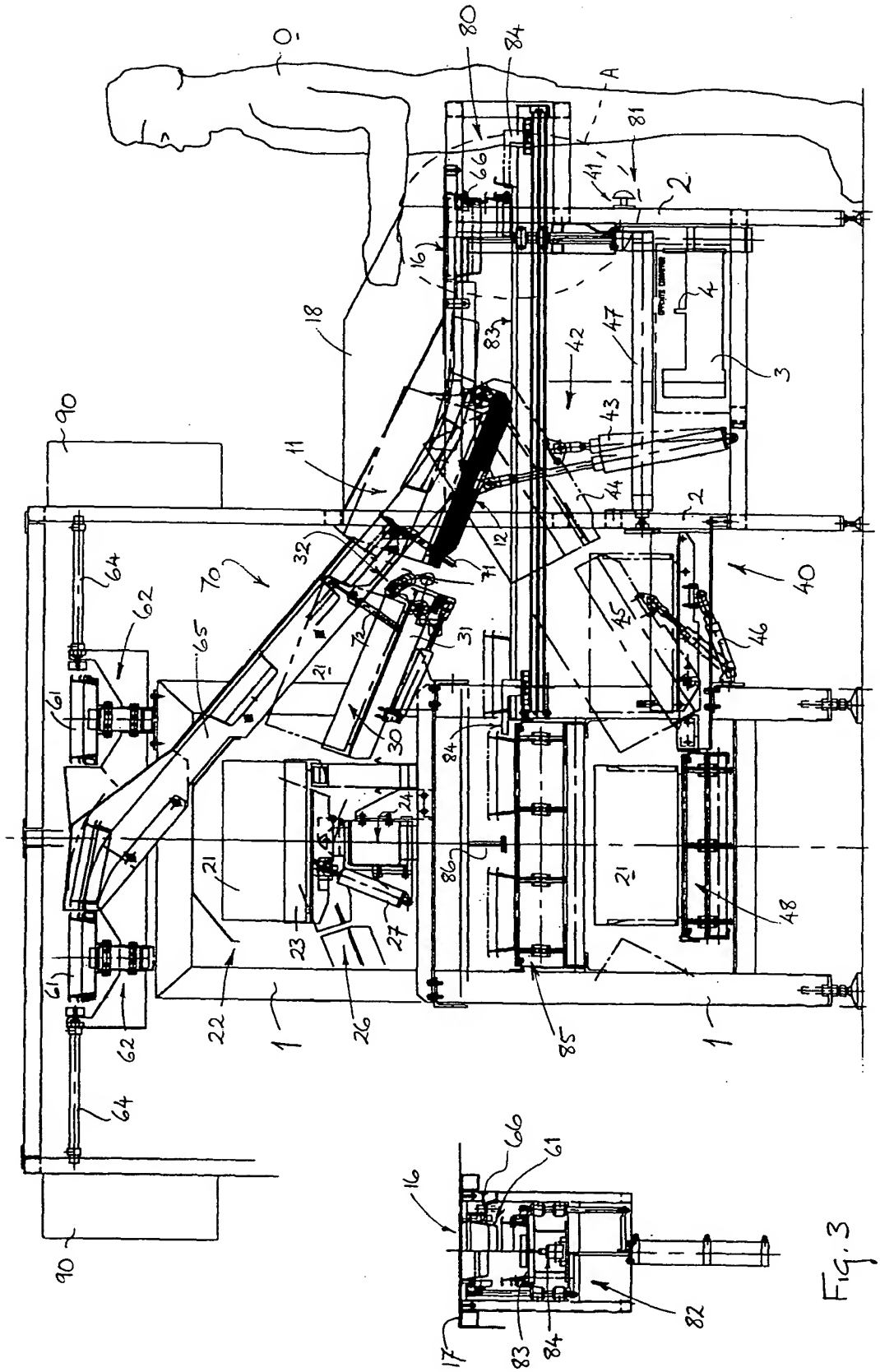
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Fig. 2

Fig. 3